ADVANCED MOTION CONTROLS

CANopen Network Bus Cabling Guide

Introduction

CAN (Controller Area Network) is a two-wire differential serial communication protocol for real-time control. *ADVANCED* Motion Controls®' CANopen drives use the CAN Physical Layer as defined by the CAN in Automation (CiA) standards DS-102 V2.0.

CAN Bus Cabling

CAN bus is a 3 wire physical medium (CAN_H, CAN_L, GND). The bus must be composed of a Giga-bit UTP (Unshielded Twisted Pair) cable having a standard 120-ohm characteristic impedance. The wiring topology should be as close to a straight line structure to avoid reflections. For a 1 Mbit/s bus, cable stubs should not exceed 0.3m. The maximum CAN bus length as specified in DS-102 V2.0 is 1km at a bit rate of 50 Kbit/s.

The CAN bus must be terminated at both ends by a 120-ohm resistor placed across CAN_H and CAN_L so that reflections of signals are avoided.

Panel mount DigiFlex® Performance™ servo drives have an internal 120-ohm resistor termination that is selectable by installing an external jumper. The last DigiFlex drive in the CAN bus chain needs to have the termination jumper installed for proper CAN bus termination. The CAN bus termination jumper is on the top of the drive next to the secondary RS232 port. A typical CAN network is shown in Figure 1 along with the termination jumper location in Figure 2.

For PCB mount DigiFlex Performance servo drives (DZC series) the termination option is selectable via DIP switch setting on the MC1XDZC02 mounting card series.

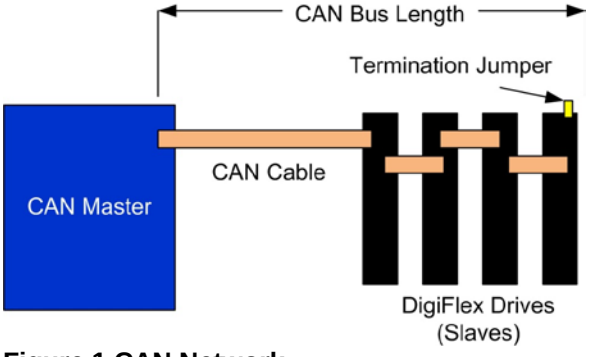

Figure 1 CAN Network

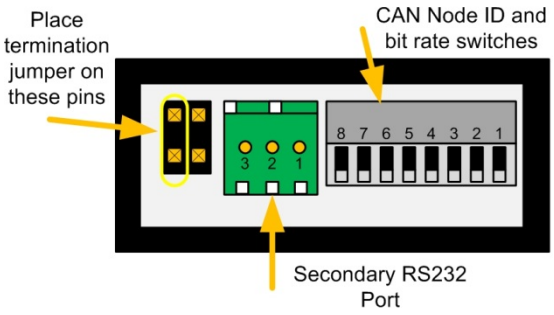

Figure 2 Termination Jumper Location on Panel Mount DigiFlex Drives

Bitrates

The CAN physical layer standard for industrial applications (DS-102 V2.0) provides guidelines on bus length and recommended bit rates.

Bus Length	Bit Rate	Bit Time
25 meters	1000 kbit/s	1 µs
50 meters	800 kbit/s	1.25 µs
100 meters	500 kbit/s	2 µs
250 meters	250 kbit/s	4 µs
500 meters	125 kbit/s	8 µs
1000 meters	50 kbit/s	20 µs
2500 meters	20 kbit/s	50 µs

Table 1 Recommended CAN Bit Rates

DigiFlex Panel Mount CAN Bus Terminals

The CAN bus connection on panel mount DigiFlex Performance drives is made by an RJ-45 connector. Two ports are provided to facilitate chaining multiple drives together.

Note: *Either port may be used. The connection is passed through the drive even if the power to the drive is OFF.*

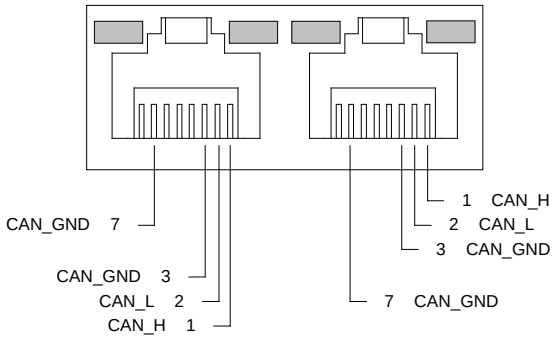

Figure 3 RJ-45 CAN Connector

Pin	Signal	Description
1	CAN_H	CAN_H bus line (dominant high)
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	CAN Ground
4	RESERVED	Reserved
5	RESERVED	
6	CAN_SHIELD	No Connection (Pass Through)
7	CAN_GND	CAN Ground
8	CAN_V+	No Connection (Pass Through)

Table 2 RJ-45 Pinout

MC1XDZC02 CAN Bus Terminal

The MC1XDZC02 mounting card series for DZC drives uses a 10-port plug terminal for the CAN bus.

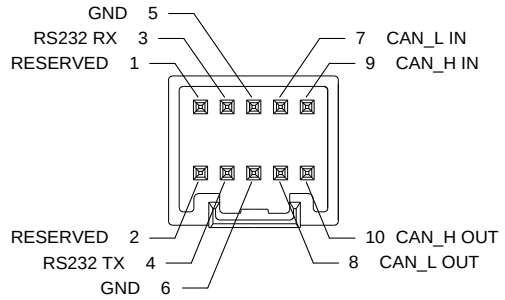

Figure 4 10-port Terminal Connector

Pin	Signal	Description
1	RESERVED	Reserved
2	RESERVED	
3	RS232 RX	Receive Line (RS-232)
4	RS232 TX	Transmit Line (RS-232)
5	GND	Ground
6	GND	
7	CAN_L IN	CAN_L bus line (dominant low)
8	CAN_L OUT	
9	CAN_H IN	CAN_H bus line (dominant high)
10	CAN_H OUT	

Table 3 10-port Terminal Pinout

The MC1XDZC02 Node ID, CANopen Bit Rate, and Termination resistor are all set using DIP Switches on the mounting card PCB.

CAN Bus Drive Setup

ADVANCED Motion Controls' CANOpen drives have hardware or software configurable bit rate and node id settings. All drives ship with their DIP Switches all 'OFF' or 'UP' for software addressing. It is recommended during initial setup to configure all drives' bit rate with the hardware switches and set each drive with a unique node ID via the hardware switches.

Note: *All drives must be configured to use the same bit rate, but each drive must have a unique Node ID.*

Troubleshooting

Most problems are caused by improper connection, poor termination, wrong bit rate selection, or Node ID configuration.

CAN card manufacturers provide CAN Bus software to send and receive messages. This software is valuable for debugging a CAN bus. DigiFlex drives at power up send out a reset message. Upon initial setup, look for this message. If the bus is healthy, the message displayed has the form:

0x700 + node ID Length 00

For Node #1: 0x701 1 00

Note: *This message is sent only at power up. Isolate the problem, then cycle drive power to send the message again.*

Use an ohm meter to check wiring. With the power off, verify 60 Ω across CAN_H and CAN_L. With the CAN bus on, use an oscilloscope to differentially measure the signal levels on the CAN bus. A two channel scope must be used. Set the scope to show both channels and set the math function to ADD. Also set the channel INVERT to ON. Send messages from the host to each node and verify the levels using Figure 5 below. Make sure signals are out of the invalid range and that rise times are < 15% of bit time.

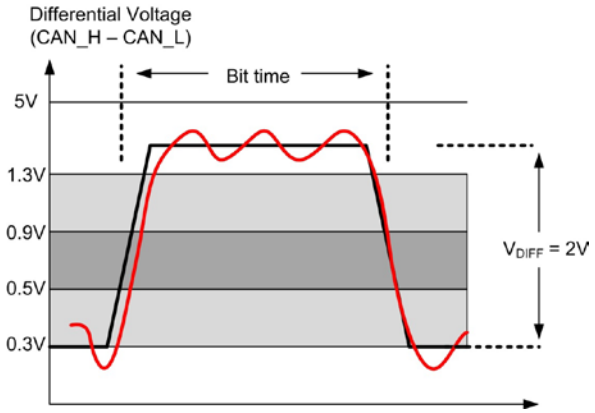

Figure 5 CAN Voltage Levels